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Connecting continuous renal replacement therapy in parallel with extracorporeal membrane oxygenation: is there no problem?

To the Editor: We read with great interest the article by Santiago *et al.*[1] The continuous renal replacement therapy (CRRT) device functioned correctly after connecting with the extracorporeal membrane oxygenation (ECMO) circuit in parallel, not in series.

Previously we observed different problematic pressures in connecting the CRRT device with the ECMO circuit in adults and children. It is clear from this article that the low blood flow rate of the CRRT device drained from the ECMO circuit will trigger the 'arterial line disconnection' alarm, owing to the positive inlet pressure exceeding the normal range. How can we ignore a prior warning of the Food and Drug Administration in 2005 on the potential risk of fluid imbalance in a Prisma device by allowing the alarm to be silenced repeatedly? Therefore, the real fluid removal from the CRRT device should be measured to make sure an accurate balance.

When we tried the same connection system in adults, the normal blood flow (150 ml/min) of the CRRT device avoided alarm because of difficulty in blood extraction, but not in blood return. Actually, the high resistance within the ECMO circuit following the centrifugal pump hindered the outlet flow of the CRRT device.[2] Again, the on-line monitoring of pressure became an obstacle. It is not recommended to override the alarm, owing to the potential risks of hemolysis and filter clotting.

Difficulty in finding vascular access for renal replacement therapy is a common problem in critically ill patients, especially in children. Thus, the utility of the ECMO circuit might be an alternative solution. However, it is inappropriate to conclude that inclusion of the CRRT device in the ECMO circuit is safe and effective without any complications in all patients.

1. Santiago MJ, Sánchez A, López-Herce J *et al.* The use of continuous renal replacement therapy in series with extracorporeal membrane oxygenation. *Kidney Int* 2009; **76**: 1289–1292.
2. Rubin S, Poncet A, Wynckel A *et al.* How to perform a haemodialysis using the arterial and venous lines of an extracorporeal life support. *Eur J Cardiothorac Surg* 2010 (in press).

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The Authors Reply: We have read Chuang *et al.*'s[1] comments about our article,[2] and would like to add some considerations:

The disconnection alarm of the Prisma machine is not triggered by a low blood flow, but rather because the machine detects a positive pressure in the inlet line generated by the extracorporeal membrane oxygenation (ECMO) pump. However, this alarm does not cause the machine to stop or alter its function, nor are there any changes in the pressure drop across the filter or in the measurement of the volumes of filtrate. In fact, the new Prismaflex machine allows function with positive pressure in the inlet line to be selected from the outset.

The continuous renal replacement therapy (CRRT) machine could have problems returning the blood as the ECMO pump maintains a high positive pressure in the circuit. However, the Prisma machine can function with return pressures of up to 350 mm Hg and, in practice, such a pressure is not reached with the blood flows usually used in children. In our experience, there are no problems with blood flows in the CRRT machine of up to 120 ml/min. However, such elevated pressures may be reached with the higher blood flows used in adults.

CRRT in children produces more complications than in adults due to the difficulty and small caliber of vascular access and the high purging volume of the CRRT system regarding the body weight of the patient.[3,4] The problems with vascular access cause frequent interruptions in CRRT function and repeated changes of the circuits due to filter coagulation, producing hemodynamic disturbances and increasing transfusion requirements.[3,4] Inclusion of the CRRT machine in the ECMO circuit considerably reduces the interruptions and substantially prolongs filter life, as shown in our study.[2] We conclude that connecting the CRRT machine to the ECMO circuit improves its handling in children. However, it is necessary to assess the correct function with each ECMO and CRRT machine and in each patient.

1. Chuang C-L, Yang W-C. Connecting continuous renal replacement therapy in parallel with extracorporeal membrane oxygenation: is there no problem? *Kidney Int* 2010; **77**: 830.
2. Santiago MJ, Sánchez A, López-Herce J *et al.* The use of continuous renal replacement therapy in series with extracorporeal membrane oxygenation. *Kidney Int* 2009; **76**: 1289–1292.
3. Santiago MJ, López-Herce J, Urbano J *et al.* Complications of continuous renal replacement therapy in critically ill children: a prospective observational evaluation study. *Crit Care* 2009; **13**: R184.
4. Del Castillo J, López-Herce J, Cidoncha E *et al.* Circuit life span in critically ill children on continuous renal replacement treatment: a prospective observational evaluation study. *Crit Care* 2008; **12**: R93.

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